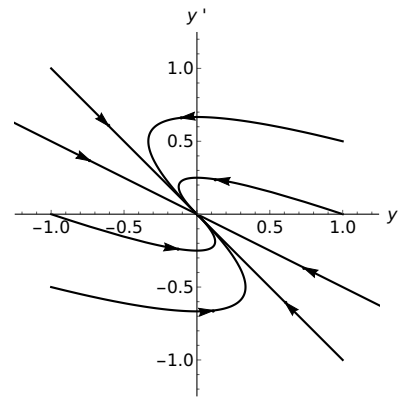


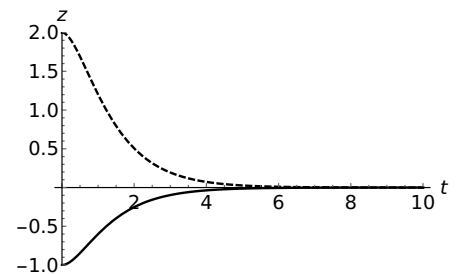
7. [12 points] In the following we consider two linear, homogeneous, second-order, constant coefficient differential equations, for  $y(t)$  and  $z(t)$ . The phase portrait for the equation for  $y(t)$  is shown to the right, and graphs of  $z(t)$  for two different initial conditions are shown in the figure to the right, below. Explain in a sentence or two why each of the following **cannot** be true.



- a. [3 points] The equation is  $y'' - 3y' + 2y = 0$

- b. [3 points] The general solution to the equation is  $y = c_1 e^{-t} + c_2 e^{-2t}$ .

- c. [3 points] Given some initial conditions, the Laplace transform  $Z(s) = \mathcal{L}\{z(t)\} = \frac{2s+4}{s^2+2s+5}$ .



- d. [3 points] Written as a system, the equation for  $z(t)$  is  $\begin{pmatrix} x_1 \\ x_2 \end{pmatrix}' = \begin{pmatrix} 0 & 1 \\ -4 & 0 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$ .